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The accuracy of ultrasound as screening method in evaluation of blunt abdominal injury in Alwahda Hospital, Derna (2000-2005)

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Abstract

Being non-invasive, repeatable, cheap, and portable, ultrasound scan is increasing becoming a mainstay method to detect injury and bleeding in blunt abdominal trauma. A prospective review of blunt trauma sonograms obtained from January 2000 to December 2005 was carried out. A total of 2160 blunt trauma sonograms were obtained, and 302 patients (14%) had intra abdominal injuries, The mean age was 33.7 ± 19.1 years (range 2-85 years), with 217 (82%) male and 85 (28%) female. There were 275 true –positive, 93 false negative, 43 false positive, and 1749 true-negative findings. Sensitivity of sonography for detecting all intra-abdominal Injuries were 74%, and specificity was 97.6%, Positive Predictive Value 94.4%, Negative Predictive Value 99.2%, Accuracy 99%. We believe that US is an excellent screening modality in the setting of blunt abdominal trauma, but it should be used only where a period of clinical observation is part of the trauma protocol. The limitations of US must be recognized, and considered in Ultrasound based decision in blunt abdominal trauma patient management. Because of its high negative predictive value, we recommend that clinical follow up is adequate for patients whose US results are negative for intra abdominal organ injury.

Hypotensive patients screened in the emergency department with positive FAST findings may be triaged directly to therapeutic laparotomy.

Key Words: Abdomen, trauma, injury, sonography, blunt abdominal trauma.

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Introduction

The care of a trauma patient is demanding and requires speed and efficiency. Evaluating patients who have sustained blunt abdominal trauma (BAT) remain one of the most challenging aspects of acute trauma care it is the need of emergency department that an optimal screening procedure for these patients should be less expensive, fast accurate, and easy to perform and portable. Ultrasonography (US) meets all these measures including this, Ultrasound can also be performed on pregnant patients, on patients with clotting disorders and above all during trauma resuscitation without interfering with the therapeutic measures. An initial prospective investigation has demonstrated screening US to have a specificity of 96% and an overall accuracy of 96% in the detection of intra abdominal injury. The use of US in evaluating blunt abdominal trauma was first reported in 1971 in Germany where kristensen (1971) described its use in the diagnosis of Splenic hematomas since late 1980, and early 1990, US is used in several trauma centers in Europe and Japan, but it was not until early 1990, that emergency physicians in the North America began showing interest in the use of Focused Abdominal Sonography for Trauma (FAST)

Free Fluid free fluid typically appears as a hypoechoic region within the peritoneal cavity or pelvis (Figure 1, 2) and typically accumulates in the upper abdomen (In the perisplenic or the perihepatic areas), depending on the site of injury. Fluid from splenic rupture or hepatic laceration may spread along the pericolic gutters and into the pelvis (Figure. 3).

Materials and Methods

Reports of US performed for the evaluation of suspected blunt abdominal trauma at a level 1 trauma center from January 2000 to December 2005 were reviewed prospectively. Patients were identified with the use of a prospectively gathered trauma registry database. The initial prospective US readings were compared with results of subsequent repeat US, CT, surgery, and/or the clinical course; the best available comparison data were used as the standard for each patient.

Technique

Trauma surgeon with general US experience of 2–20 years performed All US examinations. Studies were completed in the resuscitation suite. Residents had between 6 months to 4 years of experience interpreting US images.

In most cases, a 3.5-MHz sector probe was used, although when indicated for better imaging. The US trauma protocol, which was used for all patients in the present study, consisted of evaluation of the right and left upper quadrants of the abdomen, epigastrium, and pelvis. Attention was directed to the presence of free fluid and the US appearance of the abdominal organs, a typical abdominal US trauma protocol required approximately 10 minutes to complete.

For statistical analysis, US findings were considered positive if free fluid was present or if a parenchymal abnormality that could be consistent with trauma was identified. A positive US finding was considered true positive if CT or laparotomy revealed evidence of abdominal injury. Positive US findings were considered false positive if injury was not confirmed at subsequent studies.

Negative US findings were counted as true-negative if all other findings were negative and/or if the patient had an uneventful clinical course. All patients in this study were observed for 72 hours in a surgical ward or were admitted to the intensive care unit. US findings were considered false negative if a subsequent study revealed free fluid, hemoperitoneum, or any visceral abdominal injury. Such studies included, CT, laparotomy.

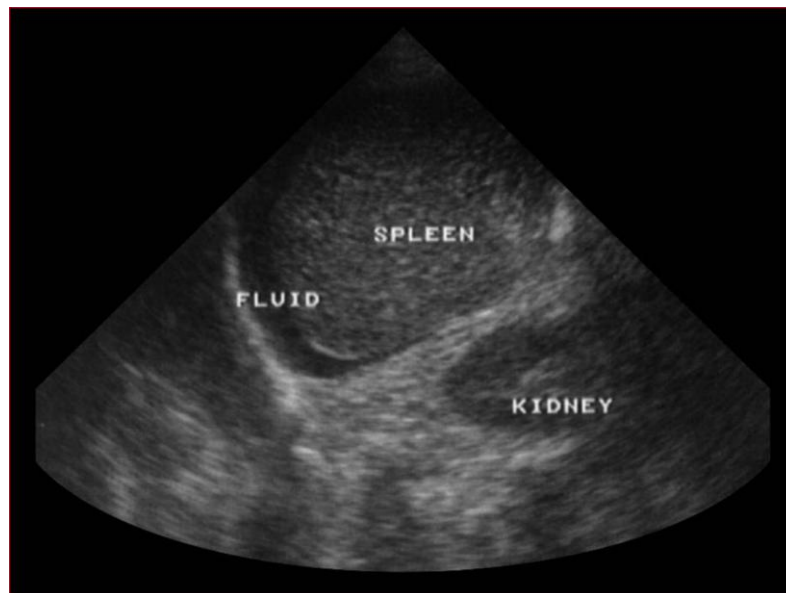


Figure 1. Free fluid in perisplenic area



Figure 2. Free fluid in perihepatic area

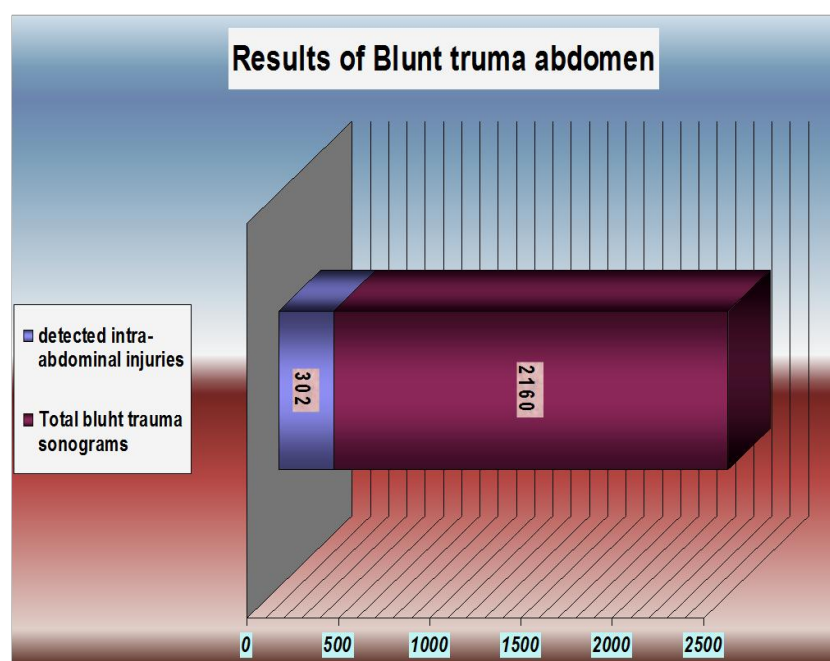


Figure 3. Results of Blunt truma abdomen

Results and Discussion

A total of 2160 blunt trauma sonograms were obtained, and 302 patients (14%) had intra abdominal injuries. The mean age was 33.7 ± 19.1 years (range 2-85 years), with 217 (82%) male and 85 (28%) female there were 275 true-positive, 93 false negative, 43 false positive, and 1749 true-negative findings (Table 1; Figure 4). Sensitivity of sonography for detecting all intra-abdominal Injuries were 74%, and specificity was 97.6%, Positive Predictive Value 94.4%, Negative Predictive Value 99.2%, Accuracy 99%.

In several recent articles (Healy, 1996; Rozycki, 1998; McElveen and Collin 1997; Shanmuganathan, 1999; Ugwu and Eroondu, 2008; Yasin *et al.*, 2014) in the trauma literature, the benefits and limitations of US following blunt abdominal trauma have been cited.

The definition of a true- or false-positive or a true- or false-negative finding also varies, which affects the calculated accuracy of US. Our results differ from those of previous authors (Chui *et al.*, 1997; Yoshii, 1998; Rozycki, 1998; Rose, 2004; Nural *et al.*, 2005) in that we had a larger proportion of false-positive study findings we used US as a screening examination and regarded any suspected abnormality as an indication for further evaluation. For this reason, we considered such a finding to represent a positive US finding. Because we were interested in detecting actual injury, the false-positive criteria described previously served to maximize the number of false-positive study findings, which decreased the specificity and positive predictive value. The most common cause of a false-positive finding in our series was a small amount of fluid seen or questioned at US but not confirmed at CT although in certain cases.

Table 1: Results of scanning of 2160 blunt abdominal

Imaging No.	True-Positive	False- Negative	True-Negative	False-Positive	Specificity (%)	Specificity (%)	Predictive Value		Accuracy (%)
							Positive	Negative	
2160	275	93	1749	43	74%	97.6%	94.4%	99.2%	99%

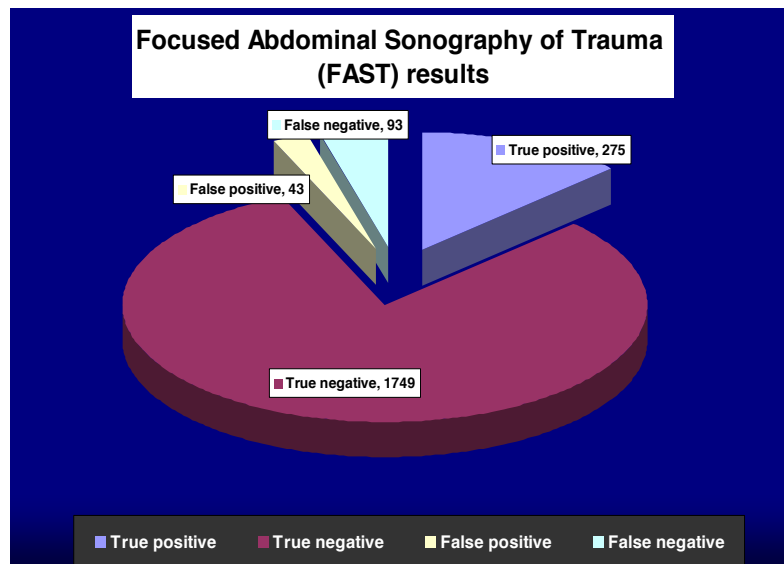


Figure 4. Focused Abdominal Sonography of Trauma (FAST) results

Initial US images did not detect injuries in 93 patients in our series. Sixteen of these patients had bowel injuries, which are known to be diagnostically challenging with CT However or US because of the development of free fluid over time. Yoshii (1998) have considered findings in such cases to be true-positive and advocate repeat examination in all patients. This failure in detection has been shown to be a limitation of focused abdominal sonography for trauma (Nordenholz, 1997; Chui, 1997).

Conclusion

We believe that US is an excellent screening modality in the setting of blunt abdominal trauma, but it should be used only where a period of clinical observation is part of the trauma protocol. The limitations of US must be recognized, and considered in Ultrasound based decision in blunt abdominal trauma patient management. Because of its high negative predictive value, we recommend that clinical follow up is adequate for patients whose US results are negative for intra abdominal organ injury.

Hypotensive patients screened in the emergency department with positive FAST findings may be triaged directly to therapeutic laparotomy.

Abbreviations:

FAST: Focused abdominal sonography for trauma, CT: Computed tomography, BAT: Blunt abdominal trauma.

References

Chiu, W. C., B. M. Cushing, A. Rodriguez, S. M. Ho, S. E. Mirvis, K. Shanmuganathan and M. Stein. (1997). Abdominal injuries without hemoperitoneum: a potential limitation of focused abdominal sonography for trauma (FAST). *J. Trauma*, 42: 617-623.

Demir Y., S. Akay, S. Yolcu, M. A. Savas, T. C. Durak and I. Parlak. (2014). Investigation of accuracy of FAST finding of multi trauma patients in comparison with abdominal CT results. *The Journal of Academic Emergency Medicine*; 13: 104-107.

Healy, M. A., R. K. Simons and R. J. Winchell. (1996). A prospective evaluation of abdominal ultrasound in blunt abdominal trauma: is it useful?. *J Trauma*; 40:875-883.

Kristensen J. K., B. Buemann and E. Kuehl. (1971). Ultrasonic scanning in the diagnosis of splenic hematomas. *Acta Chem Scand*; 137:653-657.

McElveen T. S. and G.R. Collin. (1997). The role of ultrasonography in blunt abdominal trauma: a prospective study. *Am Surg.*; 63:184-188.

Nordenholz K. E., M.A. Rubin, G.G. Gularte and H. K. Liang. (1997). Ultrasound in the evaluation and management of blunt abdominal trauma. *Ann Emerg Med*; 29:357-365.

Nural M.S., T. Yordan, H. Guven, A. Baydin, L.K. Bayrak and C. kati. (2005). Diagnostic value of ultrasonography in the evaluation of blunt abdominal trauma. *Diagnostic Interval. Radiology*, 11:41-44.

Rose S. (2004). Ultrasound in abdominal trauma. *Emerg Med Clin N Am.* , 22:581-599.

Rozycki G. S., R. B. Ballard, D.V. Feliciano, J. A. Schmidt and S.D. Pennington. (1998). Surgeon-performed ultrasound for the assessment of truncal injuries: lessons learned from 1540 patients. *Ann. Surgery*; 228:557-567.

Shanmuganathan K., S.E. Mirvis, C.D. Sherbourne, W.C. Chiu and A. Rodriguez. (1999). Hemoperitoneum as the sole indicator of abdominal visceral injuries: a potential limitation of screening abdominal US for trauma. *Radiology*; 212:423-430.

Ugwu A.C. and O.F. Erundu. (2008). A review of the roles of clinical ultrasound technology in blunt abdominal trauma. *African Journal of Biotechnology*; 7: 4976-4978.

Yoshii H., M. Sato and S. Yamamoto. (1998). Usefulness and limitations of ultrasonography in the initial evaluation of blunt abdominal trauma. *J Trauma*; 45:45-51.

الملخص العربي

يعتبر كشف الموجات الصوتية كشف آمن لكونه غير تداخلي وغير اشعاعي اضافة لسهولة اعادته مرات متوالية حسب الحاجة وايضا لإمكانية اجراؤه دون الحاجة لنقل المصابين خاصة اولئك ممن هم تحت التنفس الاصطناعي أو الغائبين عن الوعي مما جعله من الفحوصات الأساسية عند الكشف علي الاصابات البطنية غير النافذة وذلك للقدرة الكبيرة علي تشخيص اصابات الاعضاء الداخلية والتجمعات الدموية بالبطن.

في هذه الدراسة التي اجريت خلال الفترة ما بين (يناير 2000 إلى ديسمبر 2005) وشملت 2160 حالة استقبلت باصابات غير نافذة بالبطن نتيجة لمسببات مختلفة ومتنوعة وأظهر الفحص وجود اصابة داخل البطن لعدد 302 مصابا (14%) كما أن النتائج تمت مقارنتها بالنتيجة النهائية للحالات وجاءت المقارنات كما يلي 275 كشف ايجابي حقيقي، 93 سلبي كاذب، 43 ايجابي كاذب، 1749 سلبي حقيقي. وعليه كانت حساسية فحص البطن بالموجات فوق الصوتية 74%، الخصوصية 97.6%، قيمة التنبؤ الايجابية 94.4%، قيمة التنبؤ السلبية 99.2%، ودقة الفحص في العموم كانت 99%.

ومن هذه النتائج نحن نعتقد أن كشف الموجات الصوتية هو طريقة ناجعة لنفي وجود اصابات البطن خاصة عندما يقترن ذلك بفترة كافية من المراقبة السريرية المشددة والتي نوصي بها كجزء أساسي من بروتوكول استقبال حالات الاصابات والحوادث كما أن الفحص الايجابي من الممكن أن يساعد في تسريع اتخاذ قرار التدخل الجراحي للمصابين بإصابات غير نافذة خاصة عندما يكونون مصحوبين بعلامات هبوط حاد بالدورة الدموية.

مفتاح الكلمات : البطن، الإصابات، كشف الموجات الصوتية، أصابات البطن غير النافذة.